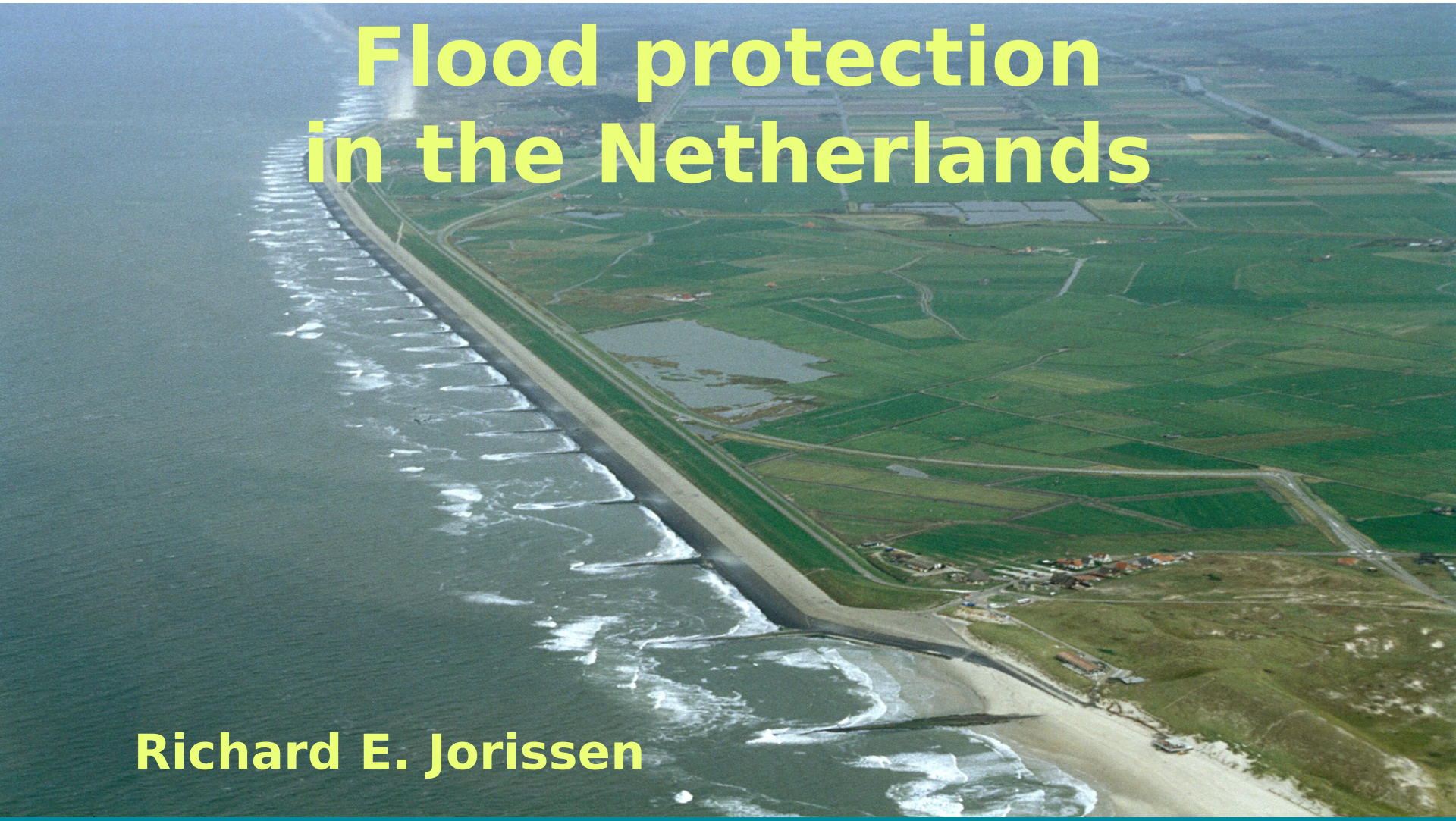
Ministerie van Verkeer en Waterstaat

Rijkswaterstaat

# Flood protection in the Netherlands

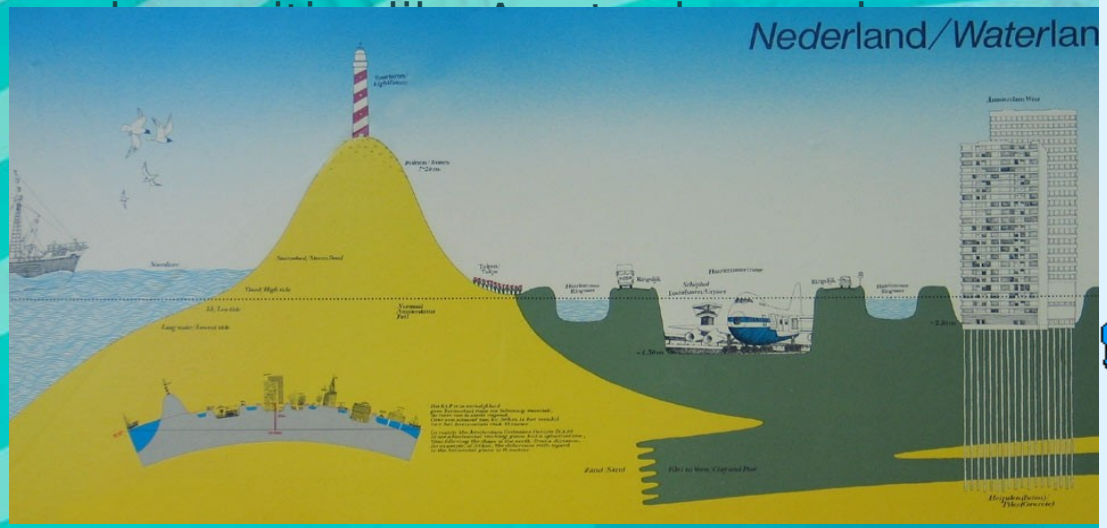


Richard E. Jorissen

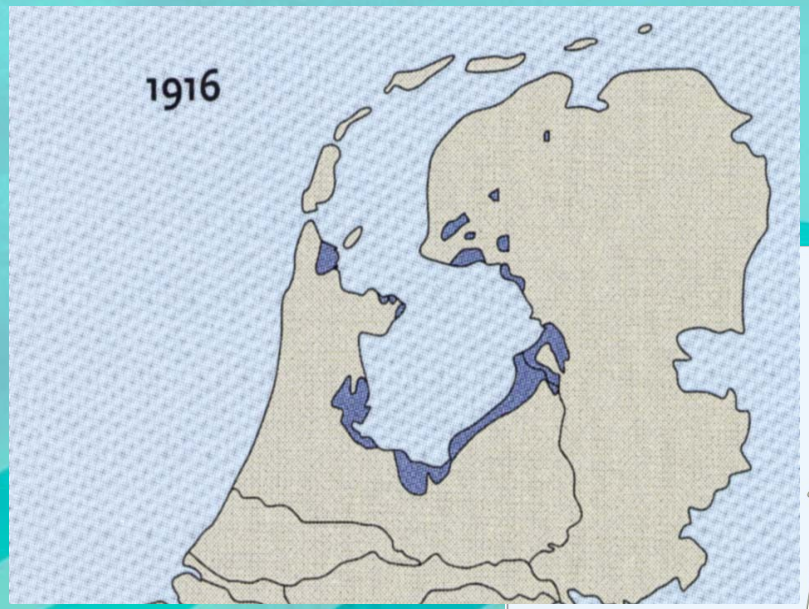
# Introduction

**Flood protection is vital for the Netherlands:**

- 60% of our country is threatened by floods
- 70% of our GNP (450 billion €) is threatened by floods

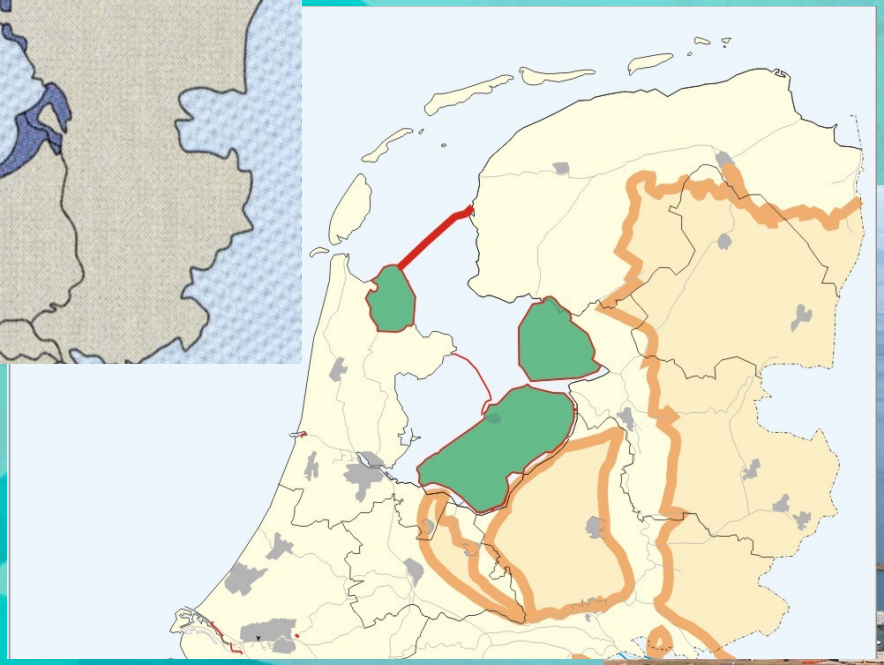


# Floods 1916




**1932: Closure of ‘Zuiderzee’**

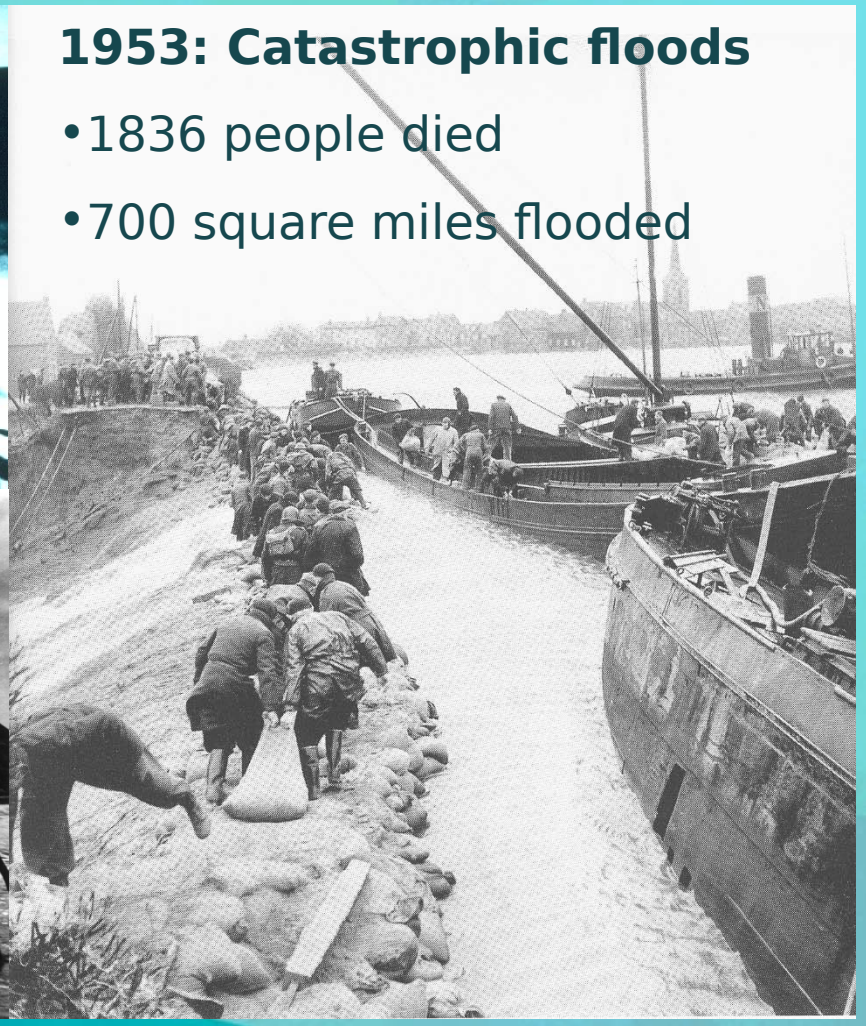
- land reclamation, flood protection and fresh water supply



# Floods 1953 and the Deltaplan

**1953: Catastrophic floods**

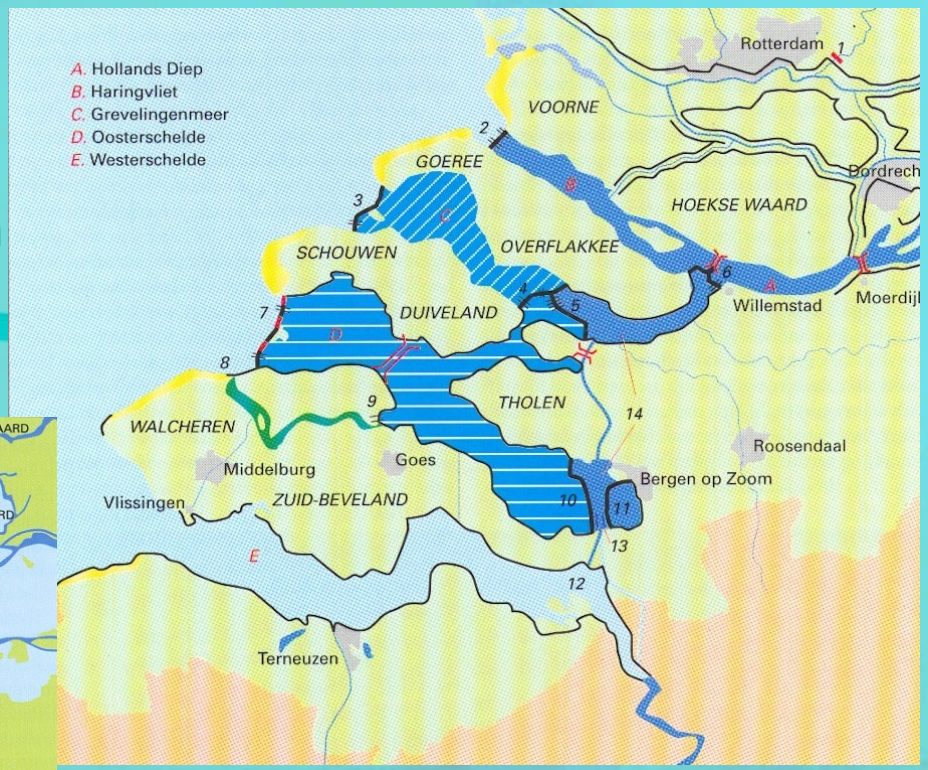
- 1836 people died
- 700 square miles flooded



# Floods 1953 and the Deltaplan

**A new start with:**

- closing off estuaries
- safety standards, based on econom
- national dike improvement scheme



# Present safety framework

**Safety is accomplished by:**

- maintaining the coastline and compensating coastal erosion
- increasing discharge capacity of the major rivers
- maintaining flood protection structures
- providing information (flood warning), conducting research and issuing guidelines

# Authorities involved

**National government/Rijkswaterstaat**

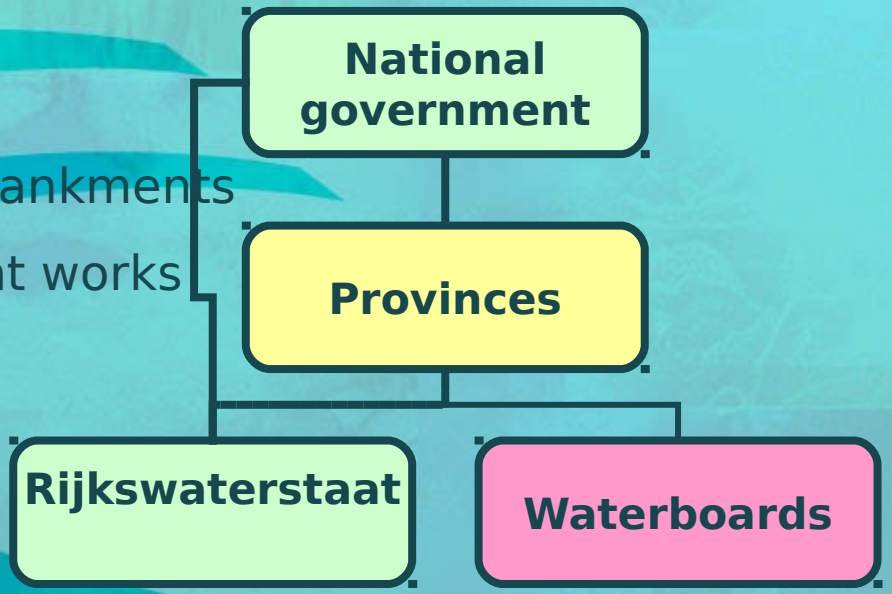
- legislation, safety standards, guidelines and hydraulic boundary conditions (sea level rise, .., ..)
- financing the reinforcement of water defenses
- management and maintenance of coastline, rivers, large lakes and large dams/barriers

**Waterboards:**

- management and maintenance embankments
- safety assessment and reinforcement works

**Provinces:**

- regional supervision
- spatial planning



# Coastal management (I)

- coastal management policy is based on holding the coastline of 1990 and compensating for sand losses in the foreshore
- holding the line (in red) takes about 8 million yd3 sand per year; compensating sand losses (in blue) in the foreshore about the same
- Rijkswaterstaat carries out a coastal management programme of 16 million yd3 per year (43 million €/year)
- if sea level rise increases from 8 to 30 inch/century, the nourishment volume increases from 16 to 40 million yd3 per year

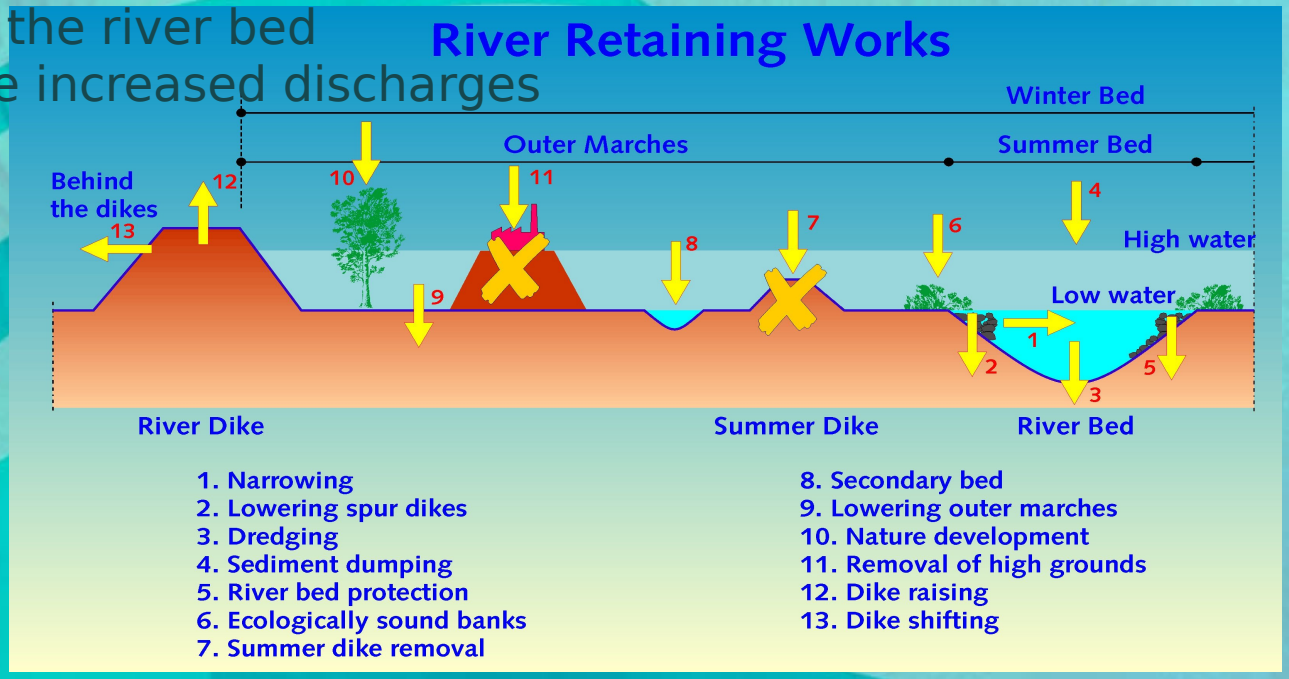
Rijkswaterstaat

# Coastal management (II)

- coastal management is based on beach and foreshore nourishment

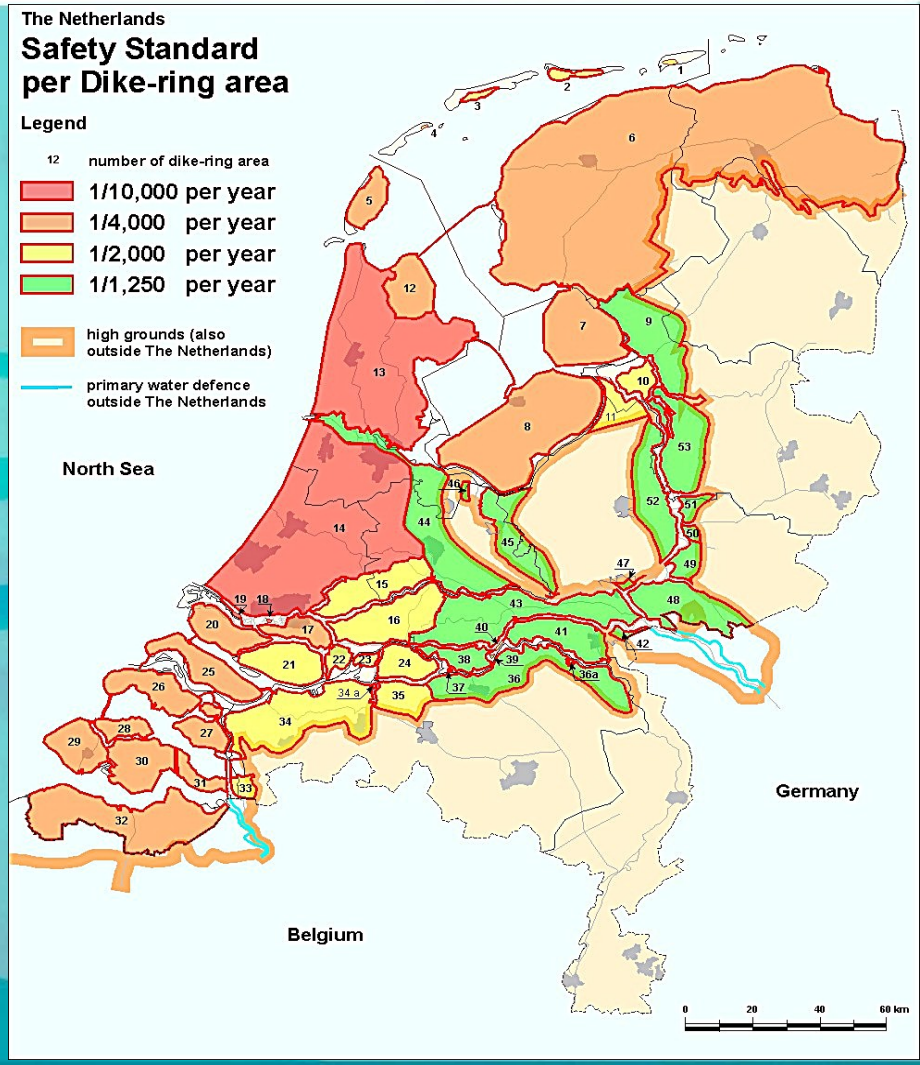
# River management

- increasing design discharges would lead to another heightening and reinforcement of river embankments
- widening, deepening and smoothening the river bed accommodate increased discharges
- project costs for the ministry are 2,4 billion €
- future management and maintenance is not yet estimated



# Flood protection structures (I)

- approximately 2200 miles primary flood protection structures with legally prescribed safety standard
- largely (90%) managed by water boards; maintenance costs (150 million €/year) are raised by local taxation
- Rijkswaterstaat manages large, complex and costly (100 million €/year) structures
- reconstruction works are paid for by the ministry (100 million €/year rising to 200 million €/year in 2010)
- secondary flood protection structures are the responsibility of provinces and waterboards



# Flood protection structures (II)

# Dunes as a natural protection

- sometimes a robust and natural protection

- sometimes on the edge of safety

# Coastal levees

- typical crest level of 40-45 feet above MSL

# The Easternscheldt Barrier

- largest and most complex closure of the Deltaplan, following the floods of 1953

- completed in 1986

# The Rotterdam barrier

- an addition to the original Deltaplan as an alternative to raising river levees in urban areas

- completed in 1997

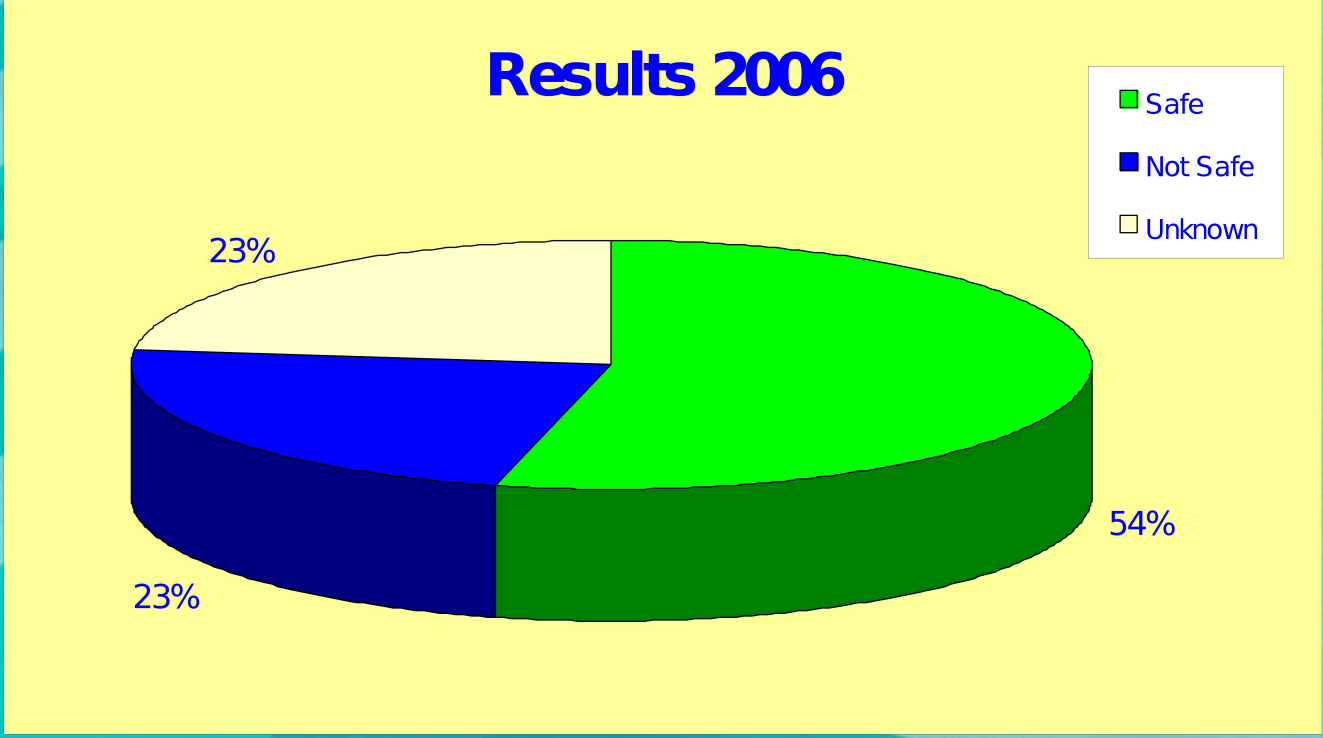
# Safety assessment

**Safety assessment:**

• carried out every 5 years by the local waterboards (since 2001)

**Provided by the central government**:

•hydraulic boundary conditions and technical criteria



# Information and research

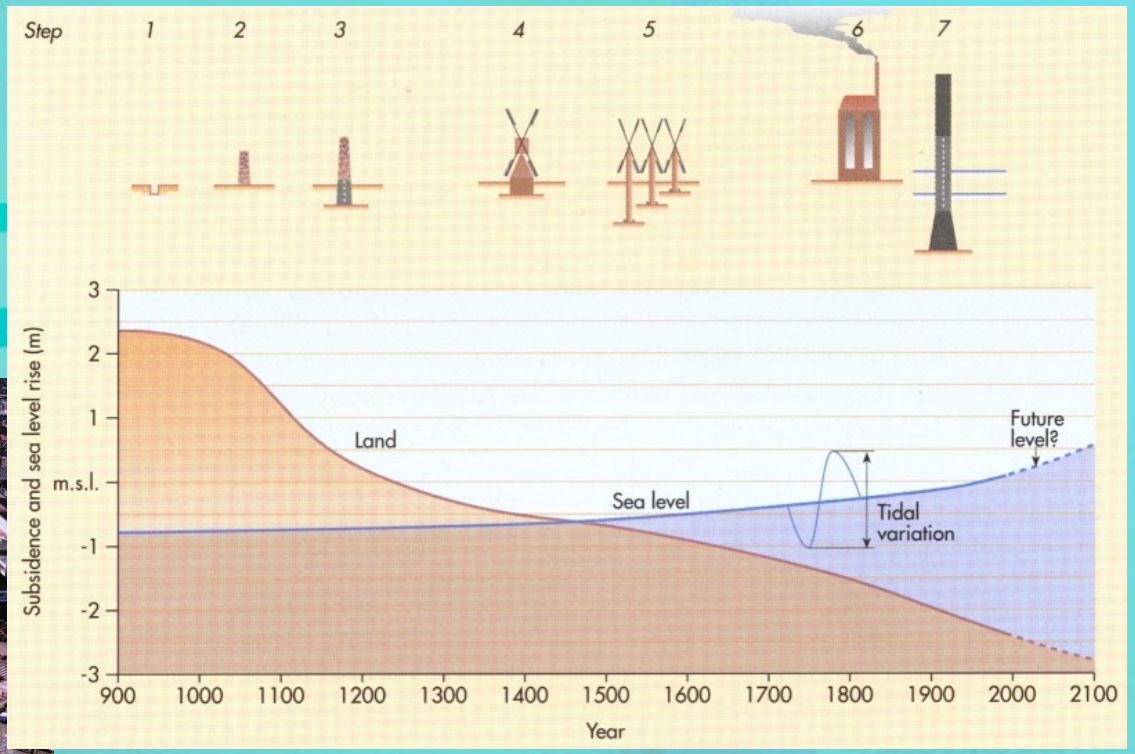
- storm surge and flood warning services
- guidelines for design and maintenance of flood protection structures
- research programme
- largely financed by the ministry; approxima

Hydraulische Randvoorwaarden 2001
voor het toetsen van primaire waterkeringen
Ministerie van Verkeer en Waterstaat
Directoraat-Generaal Rijkswaterstaat
Rijksinstituut voor Kust en Zee / RIKZ
Dienst Weg- en Waterbouwkunde
Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling / RIZA

# Future developments

**Where do we go from here?**

- sea level rise
- drainage, compaction
- societal developments



# Future developments

**Safety versus risk:**

- the lower circle depicts the present policy of maintaining a fixed safety level (sea level rise, technical developments)
- the upper circle shows the risk-based policy development, which may lead to different standards and/or different measures